1 Permutations and Combinations

1. How many two letter words can be formed using letters from the word SPACE, when repetition of letters (i) is allowed, (ii) is not allowed?

2. How many three-digit numbers can be formed from the digits 0, 1, 3, 5, 6 if repetitions of digits (i) are allowed, (ii) are not allowed?

3. How many numbers between 100 and 1000 have 4 in the units place?

4. Write in terms of factorials (i) $5 \times 6 \times 7 \times 8 \times 9 \times 10$ (ii) $3 \times 6 \times 9 \times 12 \times 15$ (iii) $6 \times 7 \times 8 \times 9$ (iv) $5 \times 10 \times 15 \times 20$

5. Evaluate : $\frac{n!}{r!(n-r)!}$ for (i) n = 8, r = 6 (ii) n = 12, r = 12, (iii) n = 15, r = 10 (iv) n = 15, r = 8

6. Find n if (i) $\frac{n}{8!} = \frac{3}{6!} + \frac{1}{4!}$ (ii) $\frac{n}{6!} = \frac{4}{8!} + \frac{3}{6!}$ (iii) $\frac{1}{n!} = \frac{1}{4!} + \frac{4}{5!}$ (iv) $(n+1)! = 42 \times (n-1)!$ (v) $(n+3)! = 110 \times (n+1)!$

7. Find n if (i) $\frac{(17-n)!}{(14-n)!} = 5!$ (ii) $\frac{(15-n)!}{(13-n)!} = 12$ (iii) $\frac{n!}{3!(n-3)!} : \frac{n!}{5!(n-5)!} = 5 : 3$ (iv) $\frac{n!}{3!(n-3)!} : \frac{n!}{5!(n-7)!} = 1 : 6$ (v) $\frac{(2n)!}{7!(2n-7)!} : \frac{n!}{4!(n-4)!} = 21 : 1$

8. Find n if $^nP_6 :^n P_3 = 120 : 1$

9. Find m and n, if $^{m+n}P_2 = 56 and^{m+n}nP_2 = 12$

10. Find r if $^12P_{r-2} :^1 1P_{r-1} = 3 : 14$

11. Find the number of permutations of the letters of the word UBUNTU.

12. How many 4 letter words can be formed using letters in the word MADHURI if (a) letters can be repeated (b) letters cannot be repeated.

13. Determine the number of arrangements of letters of the word ALGORITHM if (a) vowels are always together. (b) no two vowels are together. (c) consonants are at even positions.

14. Find the number of arrangements of the letters in the word SOLAPUR so that consonents and vowels are placed alternately.

15. Find the value of (a) $^{16}C_4$ (b) $^{80}C_2$ (c) $^{15}C_4 +^{15} C_5$ (d) $^{20}C_{16} -^{19} C_{16}$

16. Find n if (a) $^6P_2 = n^6C_2$ (b) $^{2n}C_3 :^n C_2 = 52 : 3$ (c) $^nC_{n-3} = 84$

17. Find the number of ways of selecting a team of 3 boys and 2 girls from 6 boys and 4 girls.

18. Find r if $^{11}C_4 +^{11} C_5 +^{12} C_6 +^{13} C_7 =^{14} C_r$

19. A group consists of 9 men and 6 women. A team of 6 is to be selected. How many of possible selections will have at least 3 women?

2 Set Theory

20. If A = { 1, 2, 3, 4}, B = {3, 4, 5, 6} C = {4, 5, 6, 7, 8} and universal set X = {1, 2, 3, 4, 5, 6, 7, 8, 9, 10}, then verify the following: i) $A \cup B \cap C) = (A \cup B) \cap (A \cup C)$

    ii) $A \cap (B \cup C) = (A \cap B) \cup (A \cup C)$ iii) $(A \cup B)' = (A' \cap B)'$ iv) $(A \cap B)' = A' \cup B'$ v) $A = (A \cap B) \cup (A \cap B')$ vi) $B = (A \cap B) \cup (A' \cap B)$ vii) $(A \cup B) = (A - B) \cup (A \cap B) \cup (B - A)$ viii) $A \cap (B \Delta C) = (A \cap B) \Delta (A \cap C)$ ix) $n(A \cup B) = n(A) + n(B) - n(A \cap B)$ x) $n(B) = n(A' \cap B) + n(A \cap B)$

21. If A and B are subsets of the universal set X and n(X) = 50, n(A) = 35, n(B) = 20, $n(A' \cap B') = 5$, find i) $n(A \cup B)$ ii) $n(A \cap B)$ iv) $n(A \cap B')$ iii) $n(A' \cap B)$

22. In a class of 200 students who appeared certain examinations, 35 students failed in CET, 40 in NEET and 40 in JEE, 20 failed in CET and NEET, 17 in NEET and JEE, 15 in CET and JEE and 5 failed in all three examinations. Find how many students, i) did not fail in any examination. ii) failed in NEET or JEE entrance.

23. In a hostel, 25 students take tea, 20 students take coffee, 15 students take milk, 10 student take bot tea and coffee, 8 students take both milk and coffee. None of them take tea and milk both and everyone takes atleast one beverage, find the total number of students in the hostel.

24. If $P = \{1, 2, 3\}$ and $Q = \{14\}$, find sets $P \times Q$ and $Q \times P$

25. Let A = {1, 2, 3, 4}, B = {4, 5, 6}, C = { 5, 6 }. Verify, i) $A \times (B \cap C) = (A \times B) \cap (A \times C)$ ii) $A \times (B \cup C) = (A \times B) \cup (A \times C)$

26. Let A = {6, 8} and B = {1, 3, 5} Show that $R_1 = \{(a,b)/a \in A, b \in B, a - b$ is an even number $\}$ is a null relation. $R_2 = \{(a,b)/a \in A, b \in B,$ a+b is odd number $\}$ is an universal relation.